

Prediction of Flow Behavior and Performance of an Air Conditioner Incorporating Cross-flow Fan

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Abstract

A cross-flow fan is widely used on many industrial fields: a blower for the general industry, mining industry, automobile and home appliances. The design point of the cross-flow fan is generally based on the region within low static pressure and high flow rate. It relatively makes high dynamic pressure at low speed because a working fluid passes through an impeller blade twice. However, it has low static pressure efficiency between 30% and 40% because of relative high impact loss. Recently, in the air-conditioning systems, the operating behaviors at the off-design points are highly regarded to broaden the application area for various air-cooling loads. Especially, at the low flow rate, there exists a rapid pressure head reduction, a noise increase and an irregular flow against a rearguider as a scroll of centrifugal fan. Numerical analyses are carried out for elucidating the flow characteristics and performance of a room air conditioner incorporating cross-flow fan including the impeller, the rearguider and the stabilizer. Numerical domains are discretized by hexahedral cells. Three-dimensional, unsteady governing equations are solved using FVM, PISO algorithm, sliding grid system and standard k - ϵ turbulence model. To prove the numerical results, the experiments are performed with various shapes of rearguider and stabilizer using the fan tester follows ASHRAE standards.

Keywords: *Cross-flow Fan, Performance Characteristics, Impeller, Stabilizer, Rearguider*